Answer on Question #54673, Physics Mechanics Kinematics Dynamics

Show that the direction cosine L,M,N of vectors Ax, Ay, Az is given by L=Ax/|A| , M=Ay/|A|, N=Az/|A| and hence L^2+M^2+N^2=1.

Solution

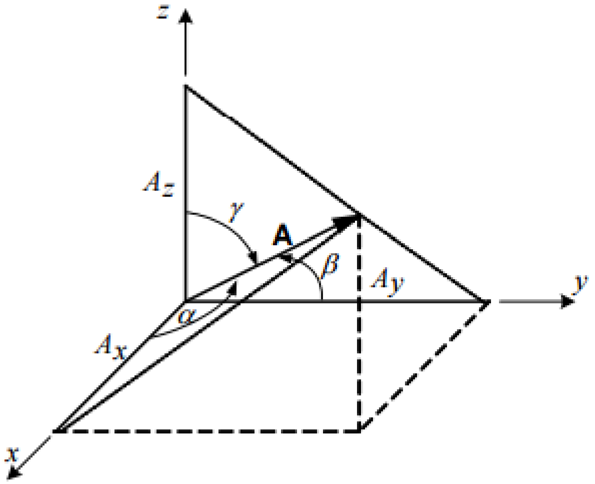

Fig.1

The cosines of the angles α, β, and γ in Fig. 1 are called the direction cosines and are designated by l, m, and n, respectively. Thus, in terms of A, A_x, A_y, and A_z

$$\begin{cases} l = \cos\alpha = A_x / A \\ m = \cos\beta = A_y / A \\ n = \cos\gamma = A_z / A \end{cases} \quad (1)$$

According to the Pythagorean theorem

$$(A_x)^2 + (A_y)^2 + (A_z)^2 = A^2 \quad (2)$$

Then

$$(A_x / A)^2 + (A_y / A)^2 + (A_z / A)^2 = 1 \quad (3)$$

So, from Eq.(1)

$$\left(l\right)^2+\left(m\right)^2+\left(n\right)^2=1 \qquad (4)$$